Conclusions: Quantifiable and reproducible radiation scatter is created during interventional procedures. Radiation doses vary widely around the perimeter of the angiography table and may be referred to as "scatter cloud." This "scatter cloud" differs from the levels predicted by the inverse square law. Knowledge of the actual exposure levels within the endovascular environment may help in mitigating these risks.

Comparative Analysis of Endarterectomy and Stenting For the Treatment of Carotid Stenosis in Women

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Introduction and objectives: Although large randomized studies have established the efficacy and safety of carotid endarterectomy (CEA) and stenting (CAS), the under-representation of women leaves the comparison of risks to benefits of performing these procedures on women an open question. To address this issue, we delineated patient characteristics predicting outcomes in women undergoing carotid interventions.

Methods: We analyzed in-hospital mortality, postoperative stroke, and the composite end points of stoke or death in 20,620 hospitalizations in New York and Florida for 2007 to 2009. Univariate and multivariable logistic regression analyses were performed.

Results: CEAs were performed in 16,576 asymptomatic and in 1744 symptomatic women and CAS in 1948 asymptomatic and in 352 symptomatic women. Compared with CAS, CEA rates were significantly lower for in-hospital mortality, stroke, and combined stroke/mortality (Table). Cardiac complication rates did not differ among asymptomatic women, but cardiac complications were more frequent among symptomatic women with CAS (10.5% vs 6.5%, $P = .008$). Among symptomatic women, the presence of renal disease, CAD, or age ≥80 years increased the risk of CAS over CEA threefold for the composite end point of stroke or death. For asymptomatic women, only in those with CAD or diabetes, there was a significant difference in the mortality/stroke rates favoring CEA. After adjusting for relevant clinical and demographic risk factors, CAS increased the risk for the composite end point of stoke or death in both symptomatic and asymptomatic patients.

Conclusions: These databases reflect real-world practice performance of the management of carotid disease in women and suggest that CEA has better perioperative outcomes in women. Importantly, CAS is associated with significant morbidity in certain clinical settings, and this should be taken into account when choosing a revascularization procedure.

In-hospital outcomes after carotid endarterectomy (*CEA*) and carotid artery stenting (*CAS*) in asymptomatic and symptomatic women

Table.

	Asymptomatic			*Symptomatic*		
Outcome	*CEA, %*	*CAS, %*	*P*	*CEA, %*	*CAS, %*	P
Mortality	0.3	0.8	.0007	0.4	3.4	<.0001
Post-op stroke	1.5	2.6	.0004	3.5	9.7	<.0001
Stroke/ mortality	1.7	3.1	<.0001	3.8	11.1	<.0001

Comparison of Carotid Endarterectomy and Stenting in Real-World Practice Using a Regional Quality-Improvement Registry

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Introduction and objectives: Carotid artery stenting (CAS) remains controversial despite recent randomized controlled trials. This study compared the outcomes of CAS and carotid endarterectomy (CEA) in real-world practice.

Methods: This was a retrospective analysis of 7649 CEA and 430 CAS procedures performed at 17 centers from 2003 to 2010 within the Vascular Study Group of New England. Two primary outcome measures were (1) any in-hospital stroke or death, and (2) any stroke, death, permanent cranial nerve injury (CNI), or myocardial infarction (MI). Combined coronary artery bypass grafting and CEA procedures were excluded. Multivariate analysis was performed to identify predictors of in-hospital stroke/death in patients undergoing CAS.

Results: Patients undergoing CAS had increased prevalence of coronary artery disease, congestive heart failure, diabetes mellitus, and prior ipsilateral CEA. CAS was performed in six centers by 30 surgeons and 8 interventionalists with a case volume per operator ranging from 1 to 137. Embolic protection was used in 97% of CAS. Shunts were used in 48% of CEA. The overall in-hospital stroke/death rate was higher among patients undergoing CAS (2.3% vs 1.1%, $P = .028$), which was due to an increased risk of stroke/death in symptomatic patients. Asymptomatic patients had similar rates of stroke/death with CEA and CAS. Overall rates of stroke, death, MI, and CNI were not different between CEA and CAS. Cortical symptoms (odds ratio [OR]; 7.3; 95% confidence interval [CI], 1.8-29.3), age >70 years (OR, 5.3; 95% CI, 1.1-26.3), and CHF (OR, 3.9; 95% CI, 1.0-15.0) were predictors of stroke/death in patients undergoing CAS (Table).

Table. Outcomes of carotid endarterectomy (*CEA*) and carotid artery stenting (*CAS*) within the ascular Study Group of New England

		Overall (n = 8,079), %		*Asymptomatic (n = 5,316), %*		*Symptomatic (n = 2,761), %*	
Variable	*No.*	*Stroke, death*	*Stroke, death, CNI, MI*	*Stroke, death*	*Stroke, death, CNI, MI*	*Stroke, death*	*Stroke, death, CNI, MI*
CEA	7649	1.1	4.1	0.89	3.6	1.6	5.0
CAS	430	2.3	2.8	0.73	1.1	5.1	5.8
P		.028	0.183	.784	.027	.001	.654

CNI, Cranial nerve injury; myocardial infarction; *MI,* myocardial infarction.

Conclusions: In our regional vascular registry, CAS is performed in patients at high operative risk. The overall outcomes of CAS and CEA are similar when accounting for permanent CNI and MI. However, symptomatic patients treated with CAS are at higher risk stroke or death. CAS may be best suited for asymptomatic patients.

Patients Considered "High Risk" For Carotid Endarterectomy are at Increased Risk of Adverse Events After Carotid Artery Stenting

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Introduction and objectives: Current guidelines allow stenting as an alternative in patients considered "high risk" for carotid endarterectomy (CEA). There is conflicting evidence regarding high-risk criteria for CEA and the safety of stenting in these patients. Using CMS inclusion criteria for carotid artery stenting (CAS), we stratified patients that underwent CAS or CEA by risk status and compared their outcomes.

Methods: A retrospective record review of all CAS and CEA procedures from 2001 through 2010 at a tertiary medical center was performed. Patients were identified using International Classification of Diseases, 9th Revision, Clinical Modification codes and stratified according to Centers for Medicare and Medicaid Services high-risk status and adjusted for symptom status. We compared differences in outcomes among each subgroup of patients that underwent CAS or CEA. Multivariable logistic regression was used to determine predictors of death alone or combined 30-day adverse events of cerebrovascular accident (CVA) or transient ischemic attack (TIA), myocardial infarction (MI), or death.

Results: We identified 307 CAS patients (61.9% high-risk) and 1018 CEA patients (25.8% high-risk). Complications occurred in 18 of 190 high-risk CAS patients (9.5%), including 9 CVAs (4.7%), 4 TIAs (2.1%), 3 MIs (1.6%), and 4 deaths (2.1%). Complications occurred in 14 of 263 high-risk CEA patients (5.3%), including 10 CVAs (3.8%), 3 TIAs (1.1%), 1 MI (0.4%), and 1 death (0.4%; Table). Physiologic high-risk status predicted adverse events after CAS (odds ratio [OR] 2.54; 95% confidence interval [CI], 1.01-6.42; $P = .047$) but not after CEA (OR, 0.89; 95% CI, 0.59-2.16; $P = .36$). Controlling for physiologic high-risk and symptom status revealed CAS had an increased risk of death over CEA (OR, 10.13; 95% CI, 1.07-95.61; $P = .04$).

Table.

Variable	*No.*	*Symptomatic (%)*	*CVA (%)*	*TIA (%)*	*Death (%)*	*MI (%)*	*Combined (%)*
CAS risk							
High	190	35.2	4.7	2.1	2.1	1.6	9.5
Low	117	24.8	0.0	3.4	0.0	0.0	4.3
CEA risk							
High	263	41.4	3.8	1.1	0.4	0.4	5.3
Low	755	36.7	2.8	1.2	0.0	1.1	5.1

CAS, Carotid artery stenting; *CEA,* carotid endarterectomy; *CVA,* cerebrovascular accident; *MI,* myocardial infarction; *TIA,* transient ischemic attack.

Conclusions: Current CMS physiologic high-risk CEA criteria place patients at increased risk for adverse events for CAS. This warrants the need to reconsider patient selection criteria for CAS vs CEA in physiologically high-risk patients.

Short-term Dietary Manipulations can Attenuate the Adipose Inflammatory Response to Surgical Trauma

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Introduction and objectives: Morbid obesity is frequently associated with increased surgical morbidity and mortality, and adipose is increasingly recognized as an organ that plays an important mechanistic role in host inflammation. We thus hypothesized that diet-induced obesity drives an accentuated proinflammatory adipose response to surgical trauma and that short-term dietary intervention by switching from a high-fat diet to a normal diet can attenuate this response.

Methods: Standard surgical manipulations were performed on the left flank fat pad of 26-week-old C57Bl6 male mice fed normal chow for 20 weeks (n = 6), high-fat chow for 20 weeks (60% Kcal; n = 6), or high-fat chow for 17 weeks reversed to normal chow for 3 weeks (n = 6). Day 1 adipose was collected and the expression of the proinflammatory cytokines interleukin (IL)-1β, IL-6, and tumor necrosis factor(TNF)-α, and of the anti-inflammatory cytokine IL-10 was assessed using quantitative RT-PCR (individually normalized to day 0 adipose).

Results: Expression of all assayed mediators was induced by surgical trauma. Adipose from the group fed high-fat chow yielded an exaggerated proinflammatory cytokine signature compared with controls fed normal chow ($P = .002$ for IL-1βa and IL-6). Short-term dietary reversal significantly attenuated the IL-1β ($P = .002$) and IL-6 induction ($P = .015$).

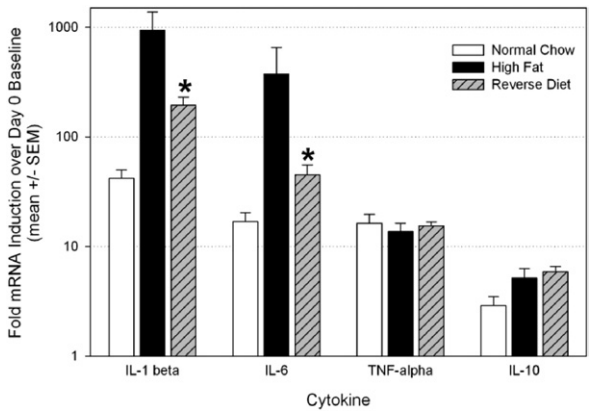

Fig.

Conclusion: Surgery induces proinflammatory and anti-inflammatory cytokine expression, and diet-induced obesity is associated with an accentuated proinflammatory cytokine response to surgical trauma. Short-term dietary switch to a normal chow diet attenuates this response. These results support a nimble adipose phenotype and suggest that periprocedural dietary interventions could affect surgical outcomes (Fig).

A Novel Model of Hind Limb Ischemia to Test Human Therapeutic Angiogenesis

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Introduction and objectives: Clinical trials injecting bone marrow-derived mononuclear cells (MNC) for therapeutic angiogenesis in patients with critical limb ischemia are currently underway. However, there are limited animal models available that adequately model human disease to allow direction of the human studies.

Methods: C57BL/6 male mice (aged 6-8 weeks) underwent unilateral high femoral artery ligation and excision; the contralateral leg was used as a control. MNC were isolated from donor mice, suspended in Roswell Park Memorial Institute 1640, and injected into the gastrocnemius. Control injections used an equal volume of medium without cells. MNC were characterized using fluorescence-activated cell-sorting analysis. Muscle blood flow was measured with "deep probe" laser Doppler. Functional Tarlov, ischemia, and modified ischemia scales were recorded at intervals before the operation and to 4 weeks after. Mice were euthanized at 1, 2, and 4 weeks for histologic analysis. Statistics were based on five random fields of view at original magnification ×40.

Results: Blood flow was significantly higher in MNC-injected mice than in controls ($P < .0001$). Tarlov scores were statistically higher throughout the first week postoperatively in MNC mice ($P = .0064$). Ischemia scores were significantly higher in MNC mice ($P = .0269$). Average number of muscle fibers was lower and fiber area was higher in MNC mice (n = 3) at all intervals ($P < .01$).

Conclusions: High femoral ligation and excision is a reproducible model of limb ischemia in C57BL/6 mice that shows response to MNC injection. These studies suggest several parameters of human trials can be tested in a small animal model in a cost-effective manner, allowing optimization of human trial parameters.

Nitrosylative Stress During Ischemia–Reperfusion Injury: Implications For Poly (Adenosine Diphosphate-Ribose) Polymerase and Nitric Oxide Synthase Activity

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Introduction and objectives: Poly (adenosine diphosphate [ADP]-ribose) polymerase (PARP) inhibition is cytoprotective during limb ischemia–reperfusion (IR) injury. Paradoxically, PARP activation may be triggered by dysfunctional nitric oxide synthase (NOS) activity. These experiments were undertaken to assess whether NOS inhibition will ameliorate skeletal muscle injury and alter PARP activity during the acute and early chronic phases of reperfusion in a mouse model of hind limb IR.

Methods: Two groups of C57BL6 mice were underwent to 1.5 hours of hind limb ischemia, followed by reperfusion. Mice were treated with the NOS inhibitor N^G-nitro-L-Arginine methyl ester (L-NAME, 50 mg/kg/d n = 10) or normal saline (n = 10) starting 1 day before IR. Hind limb muscles were harvested after 1 day or 7 days of reperfusion for histologic evaluation of skeletal muscle fiber injury and protein expression. PARP activity was assessed by Western blotting for poly-ADP-ribosylated (PAR) proteins. NOS activity was evaluated by measuring tissue nitrite, the expression of total-nNOS and the activating pS1412 and the inhibitory pS847-nNOS sites. Evidence of nitrosative stress was estimated by Western blotting for nitrotyrosine. Data were analyzed by Student *t* test.

Results: L-NAME treatment resulted in an 80% increase in the number of injured fibers compared with nitrotyrosine at day 1 IR ($P = .02$.) There was no difference in PARP activity at days 1 or 7 between the two groups. Furthermore, there was no significant difference in nitrite, nitrotyrosine, or the expression of total or pS1412-nNOS, but there was significantly less pS847-nNOS expression in the L-NAME group at day 7 ($P = .0003$).

Conclusions: L-NAME treatment exacerbates skeletal muscle fiber injury after IR but does not alter PARP activity. Because NOS inhibition (pharmacologic and through phosphorylation) does not alter nitrite or nitrotyrosine levels after injury, NOS and interactions may be partially NOS-independent during acute IR.

Western blotting data are expressed as average specific bands densities ± standard error. *$P < .001$ compared with NS.

Small Interfering RNA Coating of Prosthetic Arterial Graft Materials

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Introduction and objectives: Intimal hyperplasia (IH) remains the leading cause for prosthetic arterial graft failure. Electrospinning of the Dacron-based polymer, polyethylene terephthalate (ePET), is an appealing alternative to woven or knitted Dacron or polytetrafluoroethylene (PTFE) grafts. RNA interference is a promising tool to silence genes contributing to IH. Combining these technologies thus seemed logical. In this study, ePET and commercially available PTFE fabrics were dipped into various small interfering (si) RNA formulations, and adsorption of siRNA to the materials was investigated.

Methods: PTFE and ePET fabrics were incubated for 50 minutes in solutions containing unlabeled siRNA, siGLO Red (DyLight-547 tagged) transfection indicator siRNA, or cholesterol-siRNA-DyLight-547. siRNA was used without a transfection reagent or was complexed with JetPEI, a cationic polymer. siRNA concentrations were measured before and after fabric incubation to determine total adsorption. In a different experiment, ePET samples were dipped into siGLO Red/PEI solutions once for 50 minutes or repeatedly, 10 times for 5 minutes each, with intermittent washes in NaCl. Confocal microscopy was performed and red fluorescent density determined.

Results: Unlabeled siRNA was not adsorbed to fabrics unless complexed with PEI, whereas siGLO Red and Chol-siRNA-DyLight547 had some affinity to the materials. Overall, siRNA adsorption to ePET and PTFE